

**WHAT IS CLAIMED IS:**

1. Apparatus for the supervised administration of local anesthesia into tissues which are connected to the nerve sites to be blocked, said injection being through a hypodermic needle from which the anesthesia is forced through the connecting tissue to the nerve site comprising:

means for delivering the anesthesia through the hypodermic needle into the connecting tissue at a pre-programmed rate of flow in which the rate increases with time and in which the time of rate increase is at least a substantial portion of the entire time for the injection.

2. Apparatus according to claim 1 in which the flow rate progressively steepens with time.

3. Apparatus according to claim 2 in which at least about .4 ml of anesthesia is delivered in approximately 20 seconds.

4. Apparatus according to claim 3 in which at least about 1.7 ml of anesthesia is delivered in approximately 36 seconds.

5. Apparatus according to claim 1 further comprising means for interrupting the flow and restarting the flow at a rate equal to or below the flow rate at the time of interruption.

6. Apparatus according to claim 5 further comprising means for reducing the anesthesia flow rate responsive to a pressure which is a function of the pressure of the anesthesia at the output

of the needle.

7. Apparatus according to claim 5 further comprising means operated by the patient for reducing the anesthesia flow rate.

8. Apparatus according to claim 1 further comprising means for controlling the injection procedure operated by the medical supervisor comprising a single pole, single throw switch.

9. Apparatus according to claim 1 further comprising means for detecting and indicating to the supervisor the attainment of at least one predetermined pressure.

10. Apparatus according to claim 9 wherein said predetermined pressure is an intermediate pressure for the injection procedure.

11. Apparatus according to claim 9 wherein said predetermined pressure is a maximum pressure for the injection procedure.

12. Apparatus for the administration of local anesthesia into the tissue of a patient, said injection being through a hypodermic needle from which the anesthesia is forced through the tissue to a nerve site, comprising:

means for delivering the anesthesia through the needle into the tissue, and

means for reducing the flow of anesthesia through the needle controlled by the patient.

13. Apparatus for the administration of local anesthesia into the tissue of a patient, said injection being through a hypodermic needle from which the anesthesia is forced through the tissue to a nerve site, comprising:

means for delivering the anesthesia through the needle into the tissue; and

means for sensing at least one anesthesia pressure [at the needle] and

means for indicating at least one pre-determined pressure.

14. Apparatus according to claim 13 further comprising means for reducing the flow of anesthesia responsive to at least one pre-determined pressure.

15. Apparatus for the supervised administration of local anesthetic into the tissues of a patient through a hypodermic needle comprising:

a controllable pump comprising a first control operated by the supervisor to start and stop the flow of anesthetic from the pump, and

a second control, operated by the patient, comprising means for reducing the rate of flow of anesthetic from the pump.

1 16. Apparatus according to claim 15, wherein said second control is operative to stop the  
2 flow of anesthetic from the pump.

1 17. Apparatus according to claim 15, further comprising a third control responsive to  
2 anesthetic pressure comprising means for reducing the rate of flow of anesthetic from the pump.

1           18.     Apparatus according to claim 15, wherein said third control is operative to stop the  
2     flow of anesthetic from the pump.

1           19.     Apparatus according to claim 15, wherein said second control comprises means for  
2     re-starting the flow of anesthetic from the pump.

1           20.     Apparatus according to claim 15, wherein said pump is pre-programmed to deliver  
2     anesthetic through the needle at a preprogrammed, gradually increasing rate of flow over a  
3     predetermined period of time representing at least a substantial portion of the entire time for the  
4     injection.

1           21.     Apparatus according to claim 20, wherein said gradually increasing rate of flow is  
2     continuously increasing.

1           22.     Apparatus according to claim 15, including means for reversing the pump to perform  
2     a brief aspirating function each time the first control means is operated to stop the flow of anesthetic  
3     into the patient.

1           23.     Apparatus according to claim 17, further comprising means for indicating flow of  
2     anesthetic from the pump and a predetermined high pressure of the anesthetic in the patient.

1           24.     Apparatus according to claim 23, wherein said indicating means comprises a visual  
2     display.

1           25.    A method for the supervised administration of local anesthetic to a patient through  
2   a hypodermic needle, comprising the steps of:

3                   establishing an externally powered pump driven flow of liquid local anesthetic into  
4   a patient, and providing at least two independent controls for reducing the flow of anesthetic, one  
5   control being operated by the patient and the second by the supervisor, whereby the patient can  
6   reduce the build-up of anesthetic pressure by reducing the anesthetic flow rate.

1           26.    A method according to claim 25, further comprising the step of causing the rate of  
2   anesthetic flow into the patient to increase gradually as a function of time.

1           27.    A method according to claim 25, further comprising the step of causing the rate of  
2   anesthetic flow into the patient to increase continuously as a function of time.

1           28.    A method according to claim 25, wherein the flow rate curve progressively steepens.

1           29.    A method according to claim 25, further comprising the step of measuring the  
2   pressure of the anesthetic flowing into the patient to provide information to the supervisor as to the  
3   rate of flow of the anesthetic into the patient's tissues.

1           30.    A method according to claim 25, further comprising the step of utilizing at least one  
2   predetermined sensed pressure of the anesthetic in the patient to reduce the rate of flow of anesthetic  
3   from the pump to provide a third control of the flow of anesthetic.

1           31.    A method according to claim 30, wherein said third control stops the flow of  
2    anesthetic from the pump.

1           32.    A method for injecting local anesthetic through a hypodermic needle into the tissues  
2    of a patient, comprising the steps of:  
3                coupling a powered anesthetic pump to a hypodermic needle;  
4                implanting the needle in the patient at the injection site; and  
5                causing the pump to deliver a gradually increasing rate of flow of anesthetic through  
6    the needle over a predetermined time-interval.

1           33.    A method according to claim 32, wherein said rate of flow increases continuously.

1           34.    A method according to claim 32, in which the flow rate progressively steepens.

1           35.    A method according to claim 32, further comprising the steps of measuring the  
2    pressure of the anesthetic in the patient's tissues; and  
3                causing the flow rate from the pump into the patient to be reduced when at least one  
4    predetermined pressure is sensed.

1           36.    A method according to claim 35, wherein flow from the pump to the patient is  
2    stopped when at least one predetermined pressure is sensed.

1           37.    A method according to claim 35, further comprising the step of re-establishing the  
2   flow when the pressure of the anesthetic drops within the patient.

1           38.    A method according to claim 37, wherein the flow is re-established at the initial flow  
2   rate when the flow is re-established.

1           39.    A fluid tight coupling for joining a hollow hypodermic needle to a flexible tubular  
2   conduit comprising:

3                   a tip portion having forwardly convergent, internal, conical chamber open at its  
4   rearward end;

5                   a hollow hypodermic needle secured at its rearward end in the top portion in fluid  
6   tight relationship and communicating with the conical chamber;

7                   a conical mating portion detachably received in the conical chamber through its open  
8   end and having an axial through-bore extending rearward from its apex, said conical mating portion  
9   being formed of resilient, compressible material;

10                  a flexible tubular conduit received in the through-bore to communicate with the  
11   rearward end of the hollow needle; and

12                  cam means between the top portion and the conical mating portion for squeezing the  
13   tip portion radially inwardly against the conical mating portion in fluid tight relationship.

1           40.    A fluid tight coupling according to claim 39, said cam means also squeezing the  
2   conical mating portion radially inwardly against the flexible tubular conduit.

1           41.    A fluid tight coupling according to claim 40, comprising circumferential ribs in the  
2   through-bore and on the matable conical surfaces to augment the fluid tight seal.

1           42.    A fluid tight coupling according to claim 41, wherein said ribs on the matable conical  
2   surfaces comprise a convexly rounded surface on the conical mating portion.

1           43.    A fluid tight coupling according to claim 39, wherein said squeezing means  
2   comprises a rearwardly converging camming surface on the conical mating portion, rib means on  
3   the tip portion for engaging the camming surface and a recess in the conical mating portion to  
4   receive the engaging means in locking relationship.

1           44.    A fluid-tight coupling according to claim 39, further comprising an axially  
2   rearwardly extending portion on said conical mating portion to form a handle.

1           45.    A fluid tight conduit assembly comprising a first fluid tight coupling as set forth in  
2   claim 36 at one end of the said flexible tubular conduit, a substantially identical second fluid tight  
3   coupling at the other end of the flexible tubular conduit, and an elongated handle portion on said first  
4   fluid tight coupling, whereby the needle on the first coupling is adapted to penetrate tissue of a  
5   patient and the needle on the second coupling is adapted to penetrate a reservoir of liquid anesthetic.

1           46.    An anesthetic delivery system including the fluid tight conduit assembly as set forth  
2   in claim 45 comprising, anesthetic delivery means for pumping anesthetic from a reservoir in the  
3   form of a vial having a penetrable seal at one end, a first carriage for receiving the vial and a second



- 4 carriage for receiving said second fluid tight coupling of the conduit assembly, and control means
- 5 for establishing relative movement between the carriages to cause the needle of the fluid tight
- 6 coupling to penetrate the vial.